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Smart Systems for Logistics Command and Control (SSLC2) Spiral Two

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14. ABSTRACT
The Virtual Space Logistics Readiness Center (VSLRC) Living Laboratory was developed to provide Air Force Space Command (AFSPC) users with a consistent understanding of space system operational, equipment, communication, and logistics status. VSRLC also provides the ability to post required critical briefing materials such as Quarterly Sustainment Reviews, weekly Production Meetings, and daily Situation Reports and provide users with the most updated information that would assist in data analysis and status reporting. The purpose of this Spiral Two research was to obtain user feedback on the effectiveness of VSLRC. Users were given a questionnaire to provide feedback after they had one month to become familiar with the VSLRC software. Thirteen items of criteria were established and measured through the questionnaire. The questionnaire results support the overall success of the VSLRC project, as it met its measured criteria in twelve out of thirteen of the study's research categories including: the effectiveness of VSLRC visualizations, support for decision making, providing situation awareness, perceived satisfaction, ease of learning, ease of use, improvement in timeliness, effective and clearly presented information, usefulness, understanding of reporting functions and overall usability. Time log data were also collected which provided a benchmark for the time it takes to update weapon system status data and transfer that data into VSRLC. It can be expected that significant time savings will result when VSRLC is automatically updated and when all AFSPC personnel use VSLRC as a standard tool. Feedback related to user ideas for incorporation of real time sensing technologies were solicited and users indicated several areas where sensors would be useful.

15. SUBJECT TERMS Smart Systems for Logistics Command and Control (SSLC2), Virtual Space Logistics Readiness Center (VSLRC), Collaboration, Flightline Maintenance, Decision Making, Human Factors

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ABSTRACT

The Virtual Space Logistics Readiness Center (VSLRC) Living Laboratory was developed to provide Air Force Space Command (AFSPC) users with a consistent understanding of space system operational, equipment, communication, and logistics status. VSRLC also provides the ability to post required critical briefing materials such as Quarterly Sustainment Reviews, weekly Production Meetings, and daily Situation Reports and provide users with the most updated information that would assist in data analysis and status reporting.

The VSLRC was available to AFSPC users in November of 2005. The purpose of this Spiral Two research was to obtain user feedback on the effectiveness of VSLRC. Users were given a questionnaire to provide feedback after they had one month to become familiar with the VSLRC software. Thirteen items of criteria were established and measured through the questionnaire.

The questionnaire results support the overall success of the VSLRC project, as it met its measured criteria in twelve out of thirteen of the study's research categories including: the effectiveness of VSLRC visualizations, support for decision making, providing situation awareness, perceived satisfaction, ease of learning, ease of use, improvement in timeliness, effective and clearly presented information, usefulness, understanding of reporting functions and overall usability. Time log data were also collected which provided a benchmark for the time it takes to update weapon system status data and transfer that data into VSRLC. It can be expected that significant time savings will result when VSRLC is automatically updated and when all AFSPC personnel use VSLRC as a standard tool. Feedback related to user ideas for incorporation of real time sensing technologies were solicited and users indicated several areas where sensors would be useful.

1. Summary

The Smart Systems for Logistics Command and Control (SSLC2) program was initiated in November 2003 by the Air Force Research Laboratory Logistics Readiness Branch (AFRL/HEAL) in an effort to evaluate the most intelligent use of technology towards supporting successful decision making by the warfighter. The project's purpose was to study how to best fuse current information sources, using advanced technology to assess and present complex data to logistics and operations decision-makers in the most effective fashion. Additional goals were process improvement and support of successful collaboration.

As part of the SSLC2 program, the Virtual Space Logistics Readiness Center (VSLRC) Living Laboratory was developed and delivered in November 2005 to provide Air Force Space Command (AFSPC) users with a consistent understanding of space system operational, equipment, communication, and logistics status. Cognitive Task Analysis was accomplished through interviews with AFSPC users to storyboard weapon system core screens. Through user interface design and visualization techniques, users were provided with an intuitive display of information which requires limited user training. Each core screen was scientifically designed and developed in accordance with the storyboards to include the capability for users to manually update operational, equipment, and communications status to identify impacts of logistics actions on operations.

For satellite constellations, operational status information was obtained through a direct interface with the Mission Critical Reporting System (MCRS). This demonstrated the technological ability to receive near real-time data interfaces from source systems which provide the user with automatic status updates, and created a baseline for additional future technological advances in intelligent agent alert systems and additional source system interfaces.

The VSLRC design and development efforts also provided AFSPC users with the ability to post required critical briefing materials such as Quarterly Sustainment Reviews (QSRs), weekly Production Meetings, and daily Situation Reports (SITREPs) to provide users with the most updated information that would assist in data analysis and status reporting.

The SSLC2 Spiral Two is a research project sponsored by AFRL/HEAL designed to obtain feedback related the effectiveness of the VSLRC interface design. Towards this end, the

GRACAR team wrote and administered a questionnaire to VSLRC users, which was designed to measure the VSLRC design through a series of questions in each of the following areas:

- Perceived Effectiveness of **Visualizations**
- Perceived Effectiveness for supporting **Decision Making**
- Perceived Effectiveness for providing **Situation Awareness**
- Perceived **Satisfaction** with the system
- **Ease of Learning**
- **Timeliness** improved by system
- Information presented perceived as **Effective and Clearly Presented**
- The **Functionality** is perceived to be appropriate
- System is perceived as **Useful**
- **Reporting** functions are clear
- **Easy to Use**
- **Overall Perceived System Usability/Human Performance Improvement**
- **Overall Situation Awareness Improvement**

Benchmarks to measure success in each of these categories were quantified prior to the questionnaire delivery (score of 4.0 or better on a scale of 1 to 6). When tabulated, the Spiral Two questionnaire results indicated that the VSLRC met the criteria in twelve out of thirteen categories. For visualization, users gave an average rating of 5.0 (effective), with most users indicating the visualizations were either effective or extremely effective (6.0).

The one exception was the measurement related to functionality, which resulted in an average rating of 3.91. This benchmark was measured with only one question "Functionality is Perceived to be Appropriate". While the results are just short of the 4.0 criteria, the results showed that 9 of the 11 respondents gave a rating of 4.0 or higher. Reviewing the user comments it appears that several users were considering what VSLRC would have in future iterations. Overall, users appear to be satisfied with current functionality.

Also included in the questionnaire was an open-ended question regarding additional benefits of real-time sensing technology, such as Radio Frequency Identification / Real Time Locating System (RFID/RTLS) for future integration into VSLRC: "What information could be sensed from these assets and integrated with VSLRC to improve your decision making and where/how

would you use that information?" The answers collected from this questionnaire have been assessed for future VSLRC capabilities and presented in Section 4.0 of this report.

In addition to the questionnaire, System Support Managers (SSMs) were asked to keep time logs to indicate the time it currently takes to update weapon status information from data collection to posting reports to the Logistics Readiness Center (LRC). The SSMs entered the time associated with each weapon system over a period of ten days. The results indicated that SSMs currently spend an average of 1 hour and 16 minutes to collect the information, update PowerPoint slides, and post the information to the LRC. After the information is posted, one user updates the VSLRC to incorporate the data. It takes that user approximately 64 minutes each day to update the VSLRC and another 30 minutes to create and post the daily SITREP report. On Mondays, which require additional reports, the LRC user spends approximately 4.15 hours updating and posting reports. These times can be significantly reduced once automated reporting is in place and when SSMs use VSLRC to update status and create reports.

2. Introduction

Logistics support for the U.S. Military is a complex, time dependent, critical task. Creating Agile Combat Support (ACS) for the warfighter requires real time integrated information systems to support human decision making. Through the years, support tools have been created to support logistics problems. The SSLC2 Spiral One Final Report highlighted some of these support tools and the importance of integrating RFID and RTLS information with additional legacy systems data to give a realistic illustration of the flightline to decision makers.

In November 2003, the AFRL initiated the SSLC2 Advanced Technology Demonstration (ATD) Program researching technologies and techniques, facilitated through software, to craft information enabling the warfighter to be more agile, productive and smart about critical logistic resources required for combat operations. The Spiral Two research, explored in this report, measures an instantiation of the SSLC2 concept using the VSLRC contract modification to SSLC2, providing the AFSPC and Space and Missile Center (SMC) an actual implementation of the SSLC2 concepts. VSLRC fuses data from numerous AFSPC sources to provide logistics status of space ground assets to determine their operational capability. This research addresses space users, providing them with information to enhance situational awareness and helping them

to make the best logistics support decisions to keep operational, communication, and equipment status as high as possible.

Currently there is a need for consistent understanding of Space System operational, equipment, communication, and logistics status. The VSLRC aims to address these needs by:

- Providing an effective visualization tool to help AFSPC Personnel productively manage logistics resources in support of managing AFSPC ground assets.
- Providing an effective tool to assist AFSPC personnel in identifying impacts of logistics decisions and actions upon weapon systems operations.

With these objectives in mind, the SSLC2 team conducted the Spiral Two research to obtain user feedback related to the design and effectiveness of the VSLRC tool for fusing and presenting data for management of resources. The study objectives were:

- Evaluate user opinions on how the VSLRC supports their tasks, jobs and decisions;
- Obtain user opinions on the specific user interface design; and
- Identify opinions on improved timeliness of operational equipment and logistics status.

The GRACAR team gave VSLRC users a questionnaire to obtain feedback pertaining to the study objectives. The research was focused on assessing user opinions of the VSLRC software usability, visualizations and improvements to situational awareness provided by the new capabilities introduced into VSLRC. Data was also collected on the time it takes for AFSPC personnel to complete their manual status updating tasks.

2.1 PROGRAM SCOPE

SSCL2 is a 6.3 ATD program researching ways to make the human warfighter more agile, productive and smart about the critical logistic resources required to support combat operations. SSLC2 is an effort to make existing systems "smarter" by utilizing data collection sensor technologies and fusing data with existing information systems to improve Logistics Command and Control decision making and collaboration. The program produces research, science, methods, as well as the evaluation of how existing technologies can be value-added enhancements to existing/forthcoming systems. The SSLC2 goal is to research, demonstrate, and position for transition, technology capabilities that can be applied to and integrated into existing systems to produce logistics-based operational capability awareness. The end product will

identify requirements and demonstrate technologies that enable near real time monitoring of information on critical aspects of the logistics infrastructure. VSLRC is an example of the techniques and tools that can best enable logistics decision-makers to have a high-level view of logistics operations, identify potential problems, and make proactive decisions at various nodes within a logistics support environment where information must be identified and validated.

2.2 SSLC2 VISION AND SPIRALS

The vision of SSLC2 is to provide decision quality information from multiple data streams including real time location and status data for monitoring capabilities fused with task and legacy data to improve resource operational capability. The fused information provides decision-makers insight into the operational impact of their decisions in advance of executing the decisions. The SSLC2 effort is researching the fusion of technology with information to provide decision support and situational awareness that can affect operational capability.

Spiral One was scoped solely at wing-level personnel focusing on one primary decision: the fix/swap decision of one aircraft. The goal was to test the proof of concept of the fusion of RFID/RTLS technology with legacy data to provide decision support and situational awareness. The Scientific Study showed that the user preferred the integrated decision support tool that incorporates RFID and other logistic information based on the user tasks over RFID technology that does not, and over current practice with no technology support.

Spiral Two, the focus of this report, is an instantiation of the SSLC2 concept using the VSLRC contract modification to SSLC2, providing the AFSPC and SMC an actual implementation of the SSLC2 concepts. Rather than using RFID/RTLS technology alone, VSLRC fuses data from numerous AFSPC sources to provide logistics status of space ground assets to determine their operational capability. Spiral Two is scoped at the theater level personnel focusing on Space users, providing fused information to enhance situational awareness, and for making logistics support decisions to keep operational, communication, and equipment status as high as possible. Whereas the previous process was manual and non-standard across the space systems, Spiral Two research focused on assessing user opinions of the visualizations and improvements to situational awareness provided by the new capabilities of VSLRC.

Spiral Three will expand on the work accomplished in Spirals One and Two by focusing on how enhanced data streams impact complex multiple decisions. Collaboration among users and integration of information is a key part of this Technology Availability Date (TAD). Multiple users will have access to the same information. The users will be able to work multiple problems on multiple aircraft at the same time, and envision how decisions affect the flight line theatre from a macro, rather than micro view. The technology concept will be expanded beyond RFID/RTLS location information to include additional sensor information, facilitation of collaboration and enhanced system decision logic. Future research questions include: How do the visualization techniques affect the decision making process? Is the collaboration afforded by the system providing synergy? Does the data fusion provided by the system improve the timeliness of information extraction and decision making? How is situation awareness (SA) affected? A key component of the research will be SA, including the evaluation of both global (entire flightline) and local (current specific problem) SA.

2.3 DOCUMENT OVERVIEW

The Spiral Two Final Report presents the method and results of a questionnaire designed to obtain user feedback related to the effectiveness of the VSLRC interface design. It describes the various research activities of data collection, design, development, and data analysis performed during Spiral Two. The report is organized into the following sections: Section One gives a brief summary of VSLRC Spiral Two. Section Two outlines the program's scope. Section Three, the Methods, Assumptions and Procedures section, highlights the research objectives and steps taken to prepare the questionnaire that was distributed to VSLRC users. Section Four, presents an analysis of the study results and implications for future work. Section Five, summarizes the Spiral Two report given the study results. Finally, Section six, Recommendations, gives suggestions for future work including possible research and enhancements related to the VSLRC.

Appendices attached include a list of this document's Symbols, Abbreviations, and Acronyms (Appendix A); the instructions for completing VSLRC Time Logs and Sample Log for both SSMs and LRC Users (Appendix B); VSLRC Questionnaire Background and Read-Ahead Material (Appendix C); Instructions for Completing the Spiral Two Questionnaire (Appendix D), and finally the Spiral Two Questionnaire Results and Feedback (Appendix E).

3. Methods, Assumptions, and Procedures

All Spiral Two research materials, including the actual questionnaire and instructions, are included in the Appendices of this document. The following points detail the objectives of the research, and the methodology and procedures employed in its implementation and interpretation.

3.1 RESEARCH OBJECTIVES

The study objectives were aligned with the VSLRC program Key Performance Parameters (KPPs) to:

- Evaluate timeliness of operational equipment and logistics status (KPP #1)
- Evaluate user opinions on specific user interface design (KPP #2)
- Evaluate user opinions on how VSLRC supports their tasks/job/decisions (KPP #3)

The contractor team gave VSLRC users a questionnaire to obtain feedback pertaining to the research objectives. The research was focused on assessing user opinions of the VSLRC software usability, visualizations and improvements to situational awareness and human performance provided by this new capability. The VSLRC aims to integrate all necessary logistics, maintenance, and operations data into a single system that decision-makers can use to identify, diagnose, and take corrective actions to solve logistics issues impacting operational capability LRC personnel and SSMs were also asked to complete a time log measuring the time it currently takes to perform data collection and create status reports and how long it takes to load status information to the VSLRC. Both of these data collection techniques are described in detail below.

Participants include System Support Managers (SSMs), Logistics Readiness Center (LRC) personnel, including Space and Missile Center/Logistics Readiness Group (SMC/LGX) personnel, 14th AF, AFSPC, and US Strategic Command (USSTRATCOM) personnel. The total number of solicited participants for the questionnaire was fifteen. The total number of participants for the time logs was six SSMs and one SMC/LGX LRC user.

VSLRC V3.0 was released and implemented on 17 November 2005. The GRACAR team e-mailed the Spiral Two study read ahead material two weeks after the release of VSLRC, with the

questionnaires mailed two weeks after the read-ahead. This allowed participants to use and become familiar with VSRLC for one month before they took the questionnaire.

The GRACAR team asked participants to return the questionnaire within one month from its original distribution. GRACAR sent reminder e-mails and offered the participants the option to take an abbreviated phone interview rather than complete the entire questionnaire if they had not responded after two months. Four of the participants were excluded. One participant had changed jobs and no one in that office was familiar with VSLRC. One participant did not do any work related to VSLRC. Another had seen VSLRC in a few meetings, but had never used it, and the final participant did not respond to multiple e-mail and voice mail requests. Of the eleven responses obtained, nine completed the entire questionnaire and two completed a phone interview.

During the phone interview nine questions were taken from the original question set (see Appendix E) and two questions were added to summarize their opinions related to the visualizations and situation awareness. These two questions were 1) The VSLRC visualizations are effective for viewing information by weapon system, and 2) VSLRC provides improved situation awareness of weapon systems.

3.2 SPIRAL TWO QUESTIONNAIRE

The Spiral Two questionnaire was administered to measure users opinions related to Human Performance and Software Usability, Situation Awareness, Decision Making, Visualization, and Sensors. Software Usability refers to the ease of learning, ease of use, usefulness, information presentation and satisfaction users have with the software. Situation Awareness includes awareness of assets, operational capability, system health and the ability to predict future problems. Decision Making incorporates the perceived effectiveness of decision making support for the weapons system, site and equipment. Visualization measurements evaluated visualization concepts such as information grouping and status indicators. Finally, one question was asked about the usefulness of status information gathered by sensors to the space community.

More specifically, the Spiral Two Research Study was written with groups of questions specifically designed to measure the perceived effectiveness of VSLRC in the following thirteen areas:

- Effective Visualizations
- Effective support for Decision Making
- Effective for providing Situation Awareness
- User Satisfaction with the system
- Easy to Learn
- Timeliness improved by the system
- Information presented is Effective and Clearly Presented
- Functionality is appropriate
- System is Useful
- Reporting functions are clear
- System is Easy to Use
- System improves Usability/Human Performance
- System improves overall Situation Awareness

Questions were crafted to ask the user to rank their level of agreement with a positive statement about one of the above features of VSLRC, or about the effectiveness of VSLRC in achieving one of the benefits. The questionnaire used two scales; both ranked 1 to 6, with a selection of numeral one indicating either "Strongly Disagree" or "Not at all Effective", and a selection of numeral six indicating "Strongly Agree" or "Extremely Effective". On a few selected questions where it was pertinent, users were given the option: "Not Applicable".

During questionnaire design, several published usability questionnaires were evaluated. Questions 1-25 were designed by the team to address visualization, decision making and situation awareness. Questions 26-54 were directly from published usability questionnaires [1,2,3,4].

The team grouped questions according to research topic, and set a benchmark for questions at a mean of 4.0 to draw conclusions for each grouping. Appendix E of this document contains a table of the actual questions used in the questionnaire showing the 13 research topics coded per question. The questionnaire benchmark criteria are shown in Table 1 under the Section 4, Results and Discussion.

Approximately one month after the 17 November 2005 release of VSLRC V3.0 the questionnaire was sent to participants in a MS Access format, along with directions for how to

complete and return the questionnaire. The graphic below depicts the Access database forms used to gather questionnaire information. Comments were also solicited wherever possible. For the visualization portion of the questionnaire, a picture of the VSLRC core screens was shown. Users had the ability to tailor the visualization to choose a specific weapons system via tabs (See Figure 1 below). Participants moved through the questionnaire using "next" and "previous" buttons at the bottom. Once each questionnaire was complete, participants chose "finish" and saved the file in an Excel worksheet to be e-mailed back to the SSLC2 team. The complete list of questions can be found in Appendix E, along with the results.
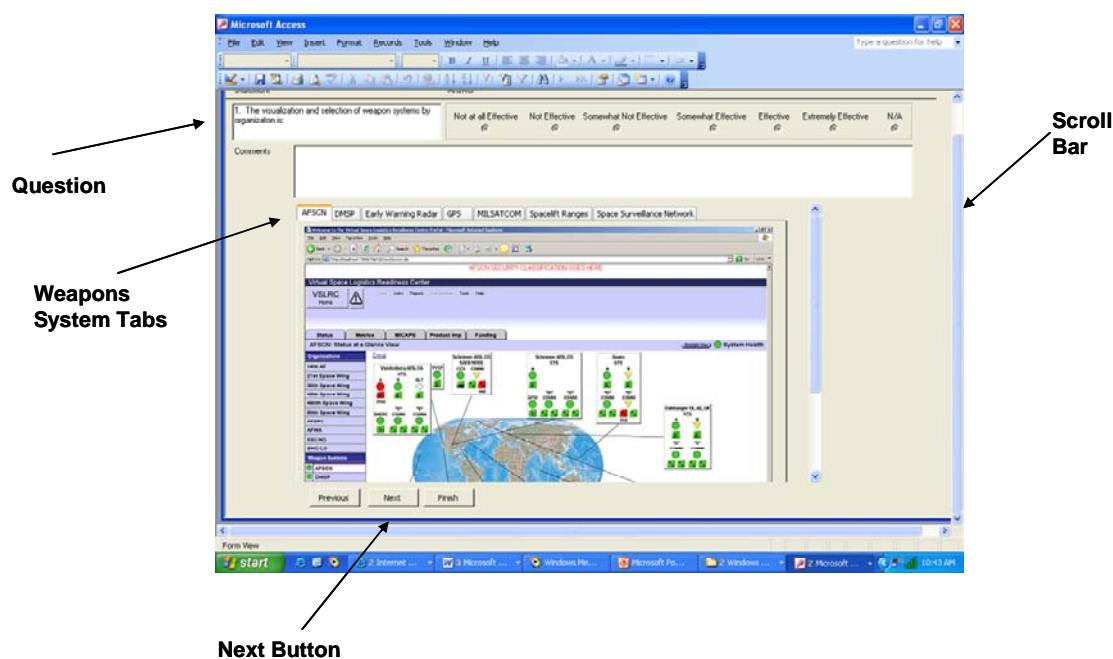
FIGURE 1: VSLRC CORE SCREEN VISUALIZATION

3.3   SPIRAL TWO TIME LOGS

The second component of the Spiral Two test was to measure the time it takes for AFSPC personnel to collect, analyze, and post the updated status information on VSLRC. One participant who currently inputs all updated status information was first interviewed about the process. This process was used to create the time logs to capture the desired information. Initial data collection with the LRC user revealed the following process for updating VSLRC (see Figure 2).

Baseline VSLRC Posting Process

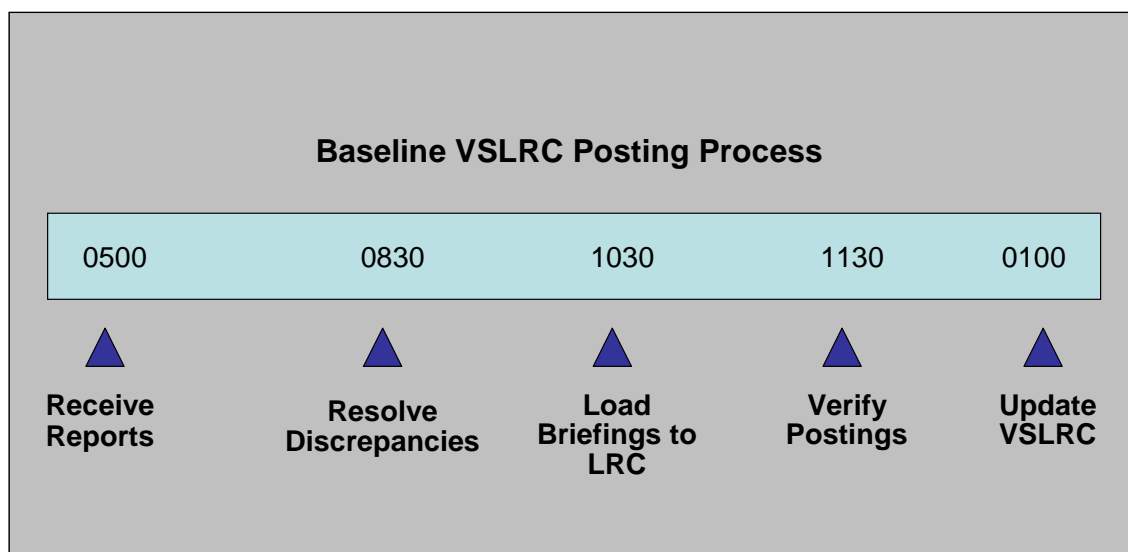| 0500	0830	1030	1130	0100
▲	▲	▲	▲	▲
Receive Reports	Resolve Discrepancies	Load Briefings to LRC	Verify Postings	Update VSLRC

FIGURE 2: PROCESSES FOR UPDATING VSLRC

At approximately 0500 a source report is received by the weapon system equipment specialist (designated by the SSM). It is usually gathered from different sources and reported in different time increments (days) depending on the weapon system. Around 0830 each weapon system representative takes their report information, conducts a teleconference about it to resolve discrepancies and translates the information into the product to be reported. The weapon system equipment specialist then converts the data to PowerPoint to include locations, color-coded statuses, and details of what is going on. At approximately 1030 equipment specialists post their PowerPoint briefing in the designated LRC Weapon System folder by going to the LRC, logging onto the Secure Internet Protocol Network (SIPRNET) computer and updating their PowerPoint briefing by downloading their daily file. All of the programs usually have their files loaded in the LRC by 1000 or 1030. At approximately 1130 the LRC representative verifies that all weapons system charts are available in the LRC. In the afternoon, the VSLRC is updated weapon system by weapon system to match the status report in the PowerPoint briefing.

After updating the weapon system information, the LRC representative generates a daily SITREP using the information from the Power Point briefings along with information from the SSMs and 14th AF. This additional data is usually hot topics by exception and comes in the form of web postings, telephones, and e-mails.

In addition to this daily routine, on Mondays four additional briefings are created for each weapons system – Status, Mission Capability (MICAPS), Metrics, and Product Improvements. These are posted in their respected tabs for each weapon system on VSLRC.

Using the above process, team members created a time log to capture the time it takes SSMs to receive status data, create their charts, and post them in the LRC. SSMs completed the log for ten days to obtain averages and this information serves as a baseline to understand the current process. A log was also created for the LRC representative to capture time for one day related to receiving and posting the SSM weapon system data on the VSLRC. The time log data entry sheets can be found in Appendix B.

4. Results and Discussion

4.1 QUESTIONNAIRE RESULTS

Table 1 below summarizes the results of the questionnaire. Appendix E provides the frequency counts and average rating for each individual question. The benchmark criterion for all categories was to obtain an average rating of 4.0 or higher. As shown in Table 1, all categories except one meet the benchmark. The question related to Functionality received a 3.91. This specific category is evaluated with only one question (question 31, "VSLRC has all the functions and capabilities I expect it to have." Of 11 participants 1 disagreed, 2 slightly disagreed, 5 slightly agreed (rating of 4), and 3 agreed (rating of 5) with this statement. Five participants provided comments. One participant commented that it was too early to evaluate. One participant seemed to be familiar with the design program and indicated that future functions were planned. Three participants indicated some additional functionality that they would like to see. It appears that overall they are satisfied with the current functions available, but anticipate future enhancements.

Eleven questions were asked related to VSLRC's ability to provide situation awareness related to space weapon systems. The average response for these combined questions meets the 4.0 criteria (average was 4.49). It should be noted that there were a total of 15 not applicable (NA) responses across these 11 questions. This may be because the concept of situation awareness was not well understood by the participants. Comments provide some insight. Five of nine participants indicated NA for the question "VSLRC is effective in providing situation

awareness of Mission Essential Subsystem List (MESL) for each weapon system". Comments indicated that they do not have any approved MESL lists. Other comments indicated that there was not enough time to have history data, and when the data are available in real-time, SA might be improved. (Specific comments can be found in Appendix E.)

Included as the final question (number 55) was an open-ended question regarding additional benefits of real-time sensing technology (such as RFID) if it was integrated into VSLRC. The question read: "What information could be sensed from these assets and integrated with VSLRC to improve your decision making and where/how would you use that information?"

Six out of eleven respondents suggested potential added future VSLRC real-time sensing technology features. Among the comments, it was suggested users would benefit from further information about any data that produces a change in the status of the system being reported, including the details about what drove the status change. One user commented that "Real time sensing will greatly enhance SA and decision making", and that the information "allows reports/talking paper to go up the chain quicker". There was a request to include the supply status, using sensors on supplies that are in forward stocking locations, to indicate the status of the shelf item when it was last tested.

Another user gave the following examples of potential added benefits: "If a ground antenna was not operating and sensors showed this in real-time and the reason was maintenance, this information would be valuable. For ranges, which have a configuration tree, (we) could see what was mandatory for launch and what was broken. Low density/low-demand assets would be valuable to track because they are something that are not used a lot, therefore, they do not have a demand on the supply system, so supply would not have spares ready, and they could have a single point of failure." He would also like the system to sense and show when radoms blow off in high winds. User comments have been noted, and will be evaluated for inclusion in future VSLRC releases or enhancements. All user comments can be found in Appendix E.

TABLE 1: QUESTIONNAIRE RESULTS

Code	Goal	Metric Goal	Actual Mean	Standard Deviation
VIS	VSLRC **visualizations** are effective.	Mean score of 4.0 or higher on questions 1-9 combined.	5.06	0.50
EDM	Perceived Effectiveness for supporting **decision making**.	Mean score of 4.0 or higher on questions 10-14 combined.	4.61	0.58
ESA	Perceived Effectiveness for providing **Situation Awareness**	Mean score of 4.0 or higher on questions 15-25 combined.	4.49	0.70
SAT	Perceived **satisfaction** with the system.	Mean score of 4.0 or higher on questions 44 and 45 combined.	4.75	0.72
ETL	System should be perceived as **easy to learn**	Mean score of 4.0 or higher on questions 26 and 38 combined.	4.61	0.61
TIM	System should improve **timeliness**	Mean score of 4.0 or higher on question 27. (KPP)	4.00	0.71
ECP	Information presented is perceived as **effective and clearly presented**	Mean score of 4.0 or higher on questions 28-30 combined.	4.44	0.58
FUN	The **functionality** is perceived to be appropriate.	Mean score of 4.0 or higher on question 31.	3.91	0.94
USE	System should be perceived as **useful**	Mean score of 4.0 or higher on questions 32-37 combined (Davis, 1989)	4.14	0.82
REP	Understanding **reporting** functions	Mean score of 4.0 or higher on questions 46-48.	4.37	0.93
EOU	System should be perceived as **easy to use**	Mean score of 4.0 or higher on questions 38-43 combined (Davis, 1989)	4.66	0.79
UUI	Overall Perceived System Usability/ Human Performance	Mean score of 4.0 or higher on all 23 usability questions (26-48) and on questions 49-51.	4.41	0.78
OSA	Overall Situation Awareness	Mean score of 4.0 or higher on questions 52-54.	4.22	0.69
Overall	Collapsed across all questions		4.44	0.72

4.2   TIME LOG RESULTS

As described in section 3.3 SSMs collect data, update slides and then post the information to the LRC. The times associated with this process are shown in Table 2.

TABLE 2: AVERAGE TIMES REPORTED BY SSM BY WEAPON SYSTEM AND TASK

Average time is in minutes; N is number of data points.

Weapon System	Collect Information	Update Slides	Update LRC
GPST	15 N= 10	10 N= 10	05 N= 10
LTRS	103 N= 7	30 N= 1	28 N= 4
SBIRS	17 N= 10	20 N= 10	15 N= 10
AFSCN	17 N= 10	62 N= 10	13 N= 10
DMSP	No Data	No Data	05 N= 10
MilSatCom	73 N= 3	08 N=3	13 N= 3
Averaged Total Time	36 (N=40)	29 (N=34)	11 (N=47)

Average time is in minutes; N is number of data points.

On average it takes approximately 1 hour and 16 minutes to collect the information, update PowerPoint slides, and post the information to LRC. The most time is spent collecting the information (average of 36 minutes). The standard deviation is large because data collection times for LTRS and MilSatCom take the most time. For Air Force Satellite Control Network (AFSCN) it took more time to update the slides (an average of 1 hour) than to collect the information. Posting the information to LRC took on average 11 minutes, with the most time spent updating LTRS.

Once the data are posted to the LRC, the LRC representative downloads the data and manually updates the VSLRC. Only one user updates the VSLRC. The user sent back a log but did not provide their start and end times. Instead they gave their estimate of duration in minutes; therefore, the data are not necessarily accurate. The data provided showed that the LRC representative updated 13 separate weapon systems and it took an average of 4.92 minutes, with a maximum time of 15 minutes and a minimum time of 2 minutes, and a standard deviation of 4.21 minutes. The total time to update all weapon systems was estimated to be 64 minutes. After the information is updated for each weapon system, the LRC representative spends another 30 minutes to create and post the daily SITREP report.

In addition to the daily tasks described above, the LRC representative creates four additional briefings for each weapon system. The time reported was 5 minutes for each weapon system for a total of 65 minutes. Additionally, 90 minutes are spent creating Monday meeting charts for the

production meeting. Therefore, on Monday the LRC representative spends a total of 249 minutes (4.15 hrs) to update weapons system information and create charts.

It is obvious from these data that updating weapon systems information is time consuming. The concept of VSLRC is to provide the opportunity for automatic updating and standardization in reporting. If all AFSPC personnel were using VSLRC to post information it would eliminate the need for the SSM to create PowerPoint slides and update them to the LCR and it would eliminate all the tasks conducted by the LRC representative because all users would have access to the same data. Additionally, when the data can be automatically input into VSLRC, the SSM would not need to input the data, only verify it. A test was conducted under the VSLRC for satellite constellations only showing that VSLRC can be tied directly to MCRS for automated updating.

5. Conclusions

VSLRC is a very important and useful tool for AFSPC. The results of this study indicate that users are satisfied with the VSLRC visualizations and interactions, it is a useable tool that is easy to learn and effective for providing situation awareness and for supporting decision making. Users would like additional functionality and suggested future enhancements including real time sensors that can provide automatic updates and reports related to each weapon system to reduce the time spent collecting data, creating slides, and posting information. The weapon system specialist would still need to do some verification and resolving of discrepancies, but could spend more time on other critical tasks. More in-depth usability testing should be conducted in order to provide input to future design enhancements.

6. Recommendations

The Spiral Two VSLRC research project demonstrates the value added of the VSLRC to space users. When VSLRC is used by all AFSPC personnel as a standard reporting and status tool, the benefits will increase. The results for this study are subjective, and a usability study that measures objective performance and the impact of this system on logistics decisions should be conducted to determine the most beneficial updates. Investigations of possible enhancements to VSLRC are also listed below. Some of these were reported in the VSLRC Living Laboratory Final Report and some were collected during this study.

- Add additional information gathered through remote real time sensing and determine how to fuse this information with existing visualizations.

- Incorporate role-based alerts that will notify users that a condition exists that may require immediate or fast attention, and are meant to inform as well as promote action.

- Display performance measures and trends over time to indicate the health of each system, potential short- and long-term problems, and ways of taking corrective action.

- Development of business rules related to Operations Capability, Systems Capability, Fully-Mission Capable, Partially-Mission Capable, and Non-Mission Capable statuses such that VSLRC can automatically calculate and identify appropriate conditions and report to AFSPC upper echelons.

- Collection of maintenance and logistics data that support metrics calculation.

- Provide the ability for users to drill-down from equipment status to underlying causes.

- Track and store actions being taken to solve logistics problems as they pertain to systems, components, items, etc.

- Information/diagnostic screens that integrate data from multiple Air Force, other DoD, and contractor legacy information and analytical systems.

- Three-dimensional map view to show precise longitude and latitude (or GPS coordinates) coordinates for each location with day/night shading.

- Ability to bi-directionally transfer information across security domains with the utilization of a guard processor.

- Ability to utilize a collaborative workspace and "chat" capability within the VSLRC resident on the SIPRNET.

- Ability to see impacts of logistics and maintenance decisions on operational readiness.

- Incorporation of real time legacy data systems for real time or near real time update of status (E.g., Government owned data sources such as Core Automated Maintenance System, Air Force Knowledge System, Standard Base Supply System, etc.)

7. References

[1] Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, *13:3*, 319-340.

[2] Lewis, J. R. (1995). IBM Computer Usability Satisfaction Questionnaires: Psychometric Evaluation and Instructions for Use. *International Journal of Human-Computer Interaction*, *7:1*, 57-78.

[3] Perlman, G. (1998). Web-Based User Interface Evaluation with Questionnaires http://www.acm.org/~perlman/question.html.

[4] Salmon, P. Stanton, N., Baber, C., Walker, G., and Green, D. (2004). Human Factors Design & Evaluation Methods Review HFIDTC/1.3.3/1-1 Human Factors Integration Defense Technology Centre.

Appendix A
Symbols, Abbreviations, and Acronyms

Acronym	Definition
ACS	Agile Combat Support
AFRL/HEAL	Air Force Research Laboratory/ Warfighter Readiness Research Division/ Logistics Readiness Branch
AFSCN	Air Force Satellite Control Network
AFSPC	Air Force Space Command
ATD	Applied Technology Demonstration
DMSP	Defense Meteorological Satellite Program
GPST	Global Positioning System
KPP	Key Performance Parameter
LRC	Logistics Readiness Center
MESL	Mission Essential Subsystem List
MICAP	Mission Capability
MCRS	Mission Critical Reporting System
QSR	Quarterly Sustainment Review
RFID	Radio Frequency Identification
RTLS	Real-Time Locating System
SA	Situation Awareness
SBIRS	Space Based Infrared System
SIPRNET	Secure Internet Protocol Network
SITREP	Situation Report
SMC	Space and Missile Center
SMC/LGX	Space and Missile Center/Logistics Readiness Group
SSLC2	Smart Systems for Logistics Command and Control
SSM	System Support Managers
TAD	Technology Availability date
USSTRATCOM	United States Strategic Command
VSLRC	Virtual Space Logistics Readiness Center

Appendix B
VSLRC Time Logs Instructions and Sample Logs

System Support Manager:

The GRACAR contracting team is requesting your support for providing feedback on the Virtual Space Logistics Readiness Center (VSLRC). VSLRC provides the Air Force Space Command (AFSPC) and Space and Missile Systems Center (SMC) logistics status of space ground assets to determine their operational capability. This program includes gaining a thorough understanding of the Space unique decision making processes, determining the logistics impacts on space operations, and providing "most-current" logistics data in "actionable" decision-quality format to VSLRC system users. Your input is crucial to ensure that the application and further development of this technology is designed to meet your needs.

The purpose of this short time log is to evaluate how the information in VSLRC improves the timeliness of work tasks and decisions. System Support Manager Representatives are asked to enter the time associated with each of the activities stated below within the next five workdays as they complete Program Status Updates. Upon completion of the log please fax this sheet to 937-281-6701, Attn: Smart Systems.

Thank you in advance for agreeing to complete the log. If you have any questions about the study please contact the GRACAR team at e.matthews@gracar.com.

System Manager User Log: One Time Log

Instructions: Please enter the hours and minutes associated with each of the activities stated below.

This information is to be used for future design improvements to the VSLRC

Date:

Program: (e.g.), AFSCN, SSN, etc.)

	Start Time	End Time
Enter time required to collect information for Program Status Update (e.g., all information necessary to make changes to PowerPoint slides). Include time required for all activities including collecting reports, teleconferences, web searches, etc.		
Enter time required to update your slides based on the known status of your system. This is *before* you take the updates to the LRC.		
Enter time required to take status information (e.g., your slides) to the LRC and update them on the LRC computer.		

PLEASE FAX THIS COMPLETED FORM TO 937-281-6701

LRC VSLRC User:

The GRACAR contracting team is requesting your support for providing feedback on the Virtual Space Logistics Readiness Center (VSLRC). VSLRC provides the Air Force Space Command (AFSPC) and Space and Missile Systems Center (SMC) logistics status of space ground assets to determine their operational capability. This program includes gaining a thorough understanding of the Space unique decision making processes, determining the logistics impacts on space operations, and providing "most-current" logistics data in "actionable" decision-quality format to VSLRC system users. Your input is crucial to ensure that the application and further development of this technology is designed to meet your needs.

The purpose of this time log is to evaluate how the information in VSLRC improves the timeliness of updating status information for each weapons system. You are asked to enter the time associated with each of the activities stated below for a period of ten workdays. Upon completion of these logs please fax to 937-281-6701, Attn; Smart Systems.

Thank you in advance for agreeing to complete the log. If you have any questions about the study please contact the GRACAR team at e.matthews@gracar.com.

VSLRC LRC User Log: Daily Log

Program		Time Modified or Posted in LRC by System Rep	Status	MICAP	Metric	Product Improvement
DATE:						
Instructions: Please enter the hours and minutes associated with each of the activities stated below. This information is to be used for future design improvements to the VSLRC.						
AFSCN	Start Time					
	End Time					
DMSP - MKIVB/RSS	Start Time					
	End Time					
DMSP - SEON	Start Time					
	End Time					
DMSP-IMS	Start Time					
	End Time					
DMSP - SBIRS	Start Time					
	End Time					
EWR	Start Time					
	End Time					
GPS	Start Time					
	End Time					
MILSATCOM - DSCS	Start Time					
	End Time					
MILSATCOM - MILSTAR	Start Time					
	End Time					
MILSATCOM - SCTS	Start Time					
	End Time					
Spacelift Range - East	Start Time					
	End Time					
Spacelift Range - West	Start Time					
	End Time					
SSN	Start Time					
	End Time					
Enter time required to create and post the daily SITREP on the VSLRC:	Start Time					
	End Time					
Enter time required to create the Monday meeting charts:	Start Time					
	End Time					

Appendix C
VSLRC Read-Ahead Document

VSLRC Questionnaire Background and Read-Ahead Material

The GRACAR contracting team is requesting your support for providing feedback on the Virtual Space Logistics Readiness Center (VSLRC). VSLRC provides the Air Force Space Command (AFSPC) and Space and Missile Systems Center (SMC) logistics status of space ground assets to determine their operational capability. This program includes gaining a thorough understanding of the Space unique decision making processes, determining the logistics impacts on space operations, and providing "most-current" logistics data in "actionable" decision-quality format to VSLRC system users. Your input is crucial to ensure that the application and further development of this technology is designed to meet your needs. To obtain feedback on the technology and visualizations used in VSLRC the GRACAR contractor team will be sending a questionnaire to VSLRC users.

Thank you in advance for agreeing to participate in this study. As a participant you will be asked to complete a questionnaire assessing the visualization, decision support, usability, situational awareness and performance support that VSLRC provides. The GRACAR contractor team will e-mail you a questionnaire that was created in MS ACCESS and instructions on how to complete the questionnaire. Please complete the questionnaire within four weeks. We will send a reminder e-mail approximately two weeks after the questionnaire has been sent if necessary.

If you have any questions about the study or have trouble obtaining the questionnaire once it is sent please contact the GRACAR team at e.matthews@gracar.com.

Appendix D
# Spiral Two Questionnaire Instructions

QUESTIONNAIRE INSTRUCTIONS

Listed below are the instructions for extracting and taking the questionnaire. If you have any questions about the study or have trouble opening the questionnaire, please contact the GRACAR team at e.matthews@gracar.com.

1. Click on the questionnaire attachment. You will be asked "Do you want to open or save this file?" Choose **Open.** It may take a couple seconds to open the file.
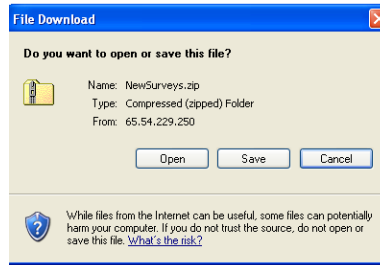
2. Once the document has been downloaded you will see the following window. Choose "**Extract all files**."
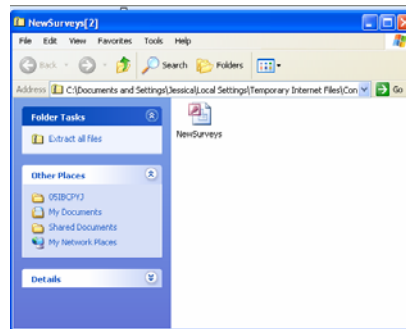
3. The Extraction Wizard will pop up. Choose **Next**. On the next screen it will tell you that the file will be saved in temporary internet files. Select Next. It will take a couple seconds to extract the file. You will then see the "Extraction Complete" window. Make sure the box "Show extracted files" is checked and choose **Finish**.
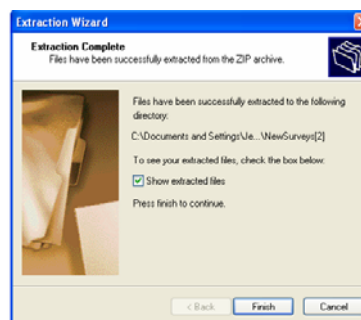
4. A new window will pop up with the Questionnaires file icon. Click on "Spiral2Questionaire". If you see a security warning and ask you if you want to open the file, click **Open**. Choose **Open**

again if you see another security warning. The security warning is caused of scripts that were written in the Access database to make it more user friendly. None of the files associated with this questionnaire are harmful to you computer.

Note: If the questionnaire will not open or if it does open but gives you an error message and is not editable try re-running step 3 but change the path. This may allow you to use the questionnaire.

5. The VSLRC Questionnaire will appear at Question 1. Use the maximize screen icon in the top right corner of the window to make sure the questionnaire is open to full screen. This allows you to see all the selections.

Please note that the questionnaire includes a graphic representation of VSLRC (see the picture below), which is intended to assist you in remembering the layout of the actual program. Please answer the questionnaire questions in relation to your experience with VSLRC itself, and not the graphics in the questionnaire.

Complete the survey by answering each question using the scale at the top. Each question has a space giving you the option to add any additional comments. We welcome your comments because they provide us with additional feedback that helps us better design and improve systems for you as a user.

Use the scroll bar at the right to view the entire page if necessary. Once a question is complete go to the next question using the **next** button. To change the graphic to reflect the view you are evaluating, choose from the weapons system tabs above the VSLRC picture.
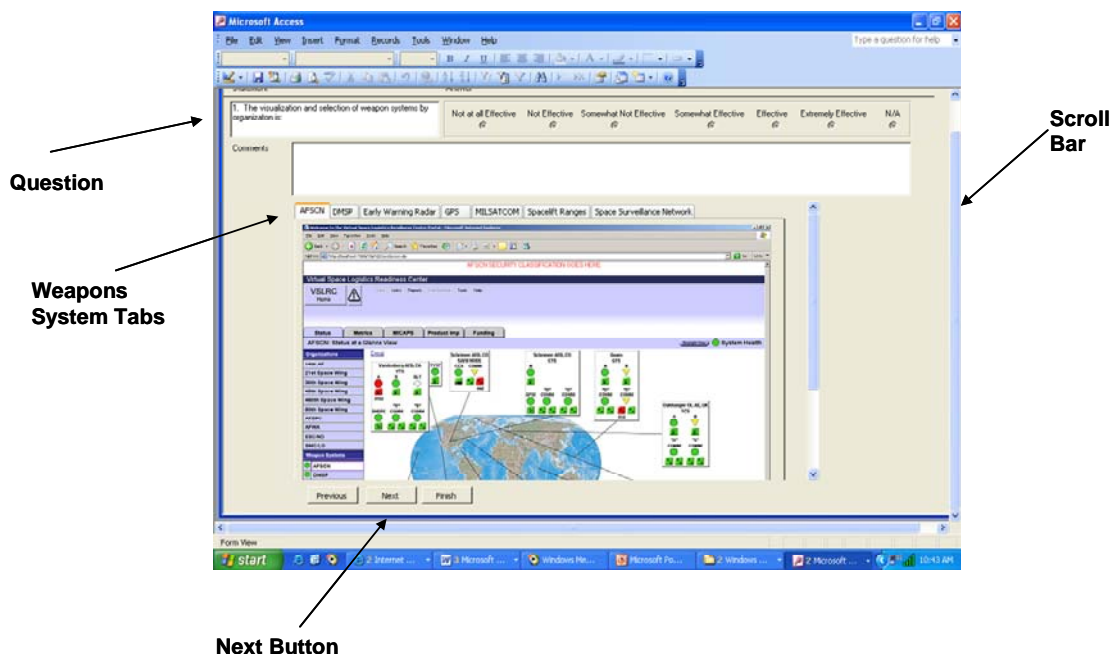
6. After completing question 55, choose **Finish**. This will save your questionnaire answers in an Excel file named "Survey" which you will find in the "My Documents" folder on your computer.

Please e-mail this Excel file to e.matthews@gracar.com. If you have any questions about the study or have trouble opening the questionnaire, please contact the GRACAR team at e.matthews@gracar.com.

Appendix E
Spiral Two Questionnaire

VSLRC Questionnaire

The questionnaire is listed below. The frequency counts for answers to each question are listed under each answer. The average score for each question is listed in the last column. The questions marked with an ** were the questions used in the phone interview for two participants. Therefore, N = 11 for these questions.

Instructions to User: Please provide a rating to each question below that best matches your **rating of effectiveness** as it relates to VSLRC.

CODE	Statements	Not at all Effective 1	Not Effective 2	Somewhat Not Effective 3	Somewhat Effective 4	Effective 5	Extremely Effective 6	NA	Average Score (Std Dev)
VIS	1. The visualization and selection of weapon systems by organization is:				1	6	2		**5.11** **(0.61)**
VIS	2. The visualization and selection of weapon systems by type is:					8	1		**5.11** **(0.33)**
VIS	3. The visualization and selection of information by site is:					7	2		**5.22** **(0.44)**
VIS	4. The visualization of status indicators directly above related equipment icons is:					7	2		**5.22** **(0.44)**
VIS	5. The visualization of geographic references are:					7	2		**5.22** **(0.44)**
VIS	6. The visualization of status indicators (yellow, green, red) are:				2	5	2		**5.0** **(7.1)**
VIS	7. The equipment status icons, including ETRO days, are:				1	7	1		**5.0** **(0.50)**

CODE	Statements	Not at all Effective 1	Not Effective 2	Somewhat Not Effective 3	Somewhat Effective 4	Effective 5	Extremely Effective 6	NA	Average Score (Std Dev)
VIS	8. Labels on status indicators, equipment, etc. are:				3	6			**4.67** **(0.50)**
VIS**	9. Overall, the visualization of the weapons system view is:				1	9	1		**5.0** **(0.33)**
EDM	10. With regard to supporting my decision making process, the ability to see the status of all weapons systems is:				2	7			**4.78** **(0.44)**
EDM	11. With regard to supporting my decision making process for a weapons system, the information provided is:				3	6			**4.67** **(0.50)**
EDM	12. With regard to supporting my decision making process for any given site, the information provided is:				2	7			**4.78** **(0.44)**
EDM	13. With regard to supporting my decision making process for any given piece of equipment, the information provided is:				5	4			**4.44** **(0.53)**
EDM**	14. With regard to supporting my decision making process, VSLRC is:			2	2	6		1	**4.4** **(0.84)**

The following graphic points out the sections of the VSLRC visualization that each of questions one through eight pertains to:
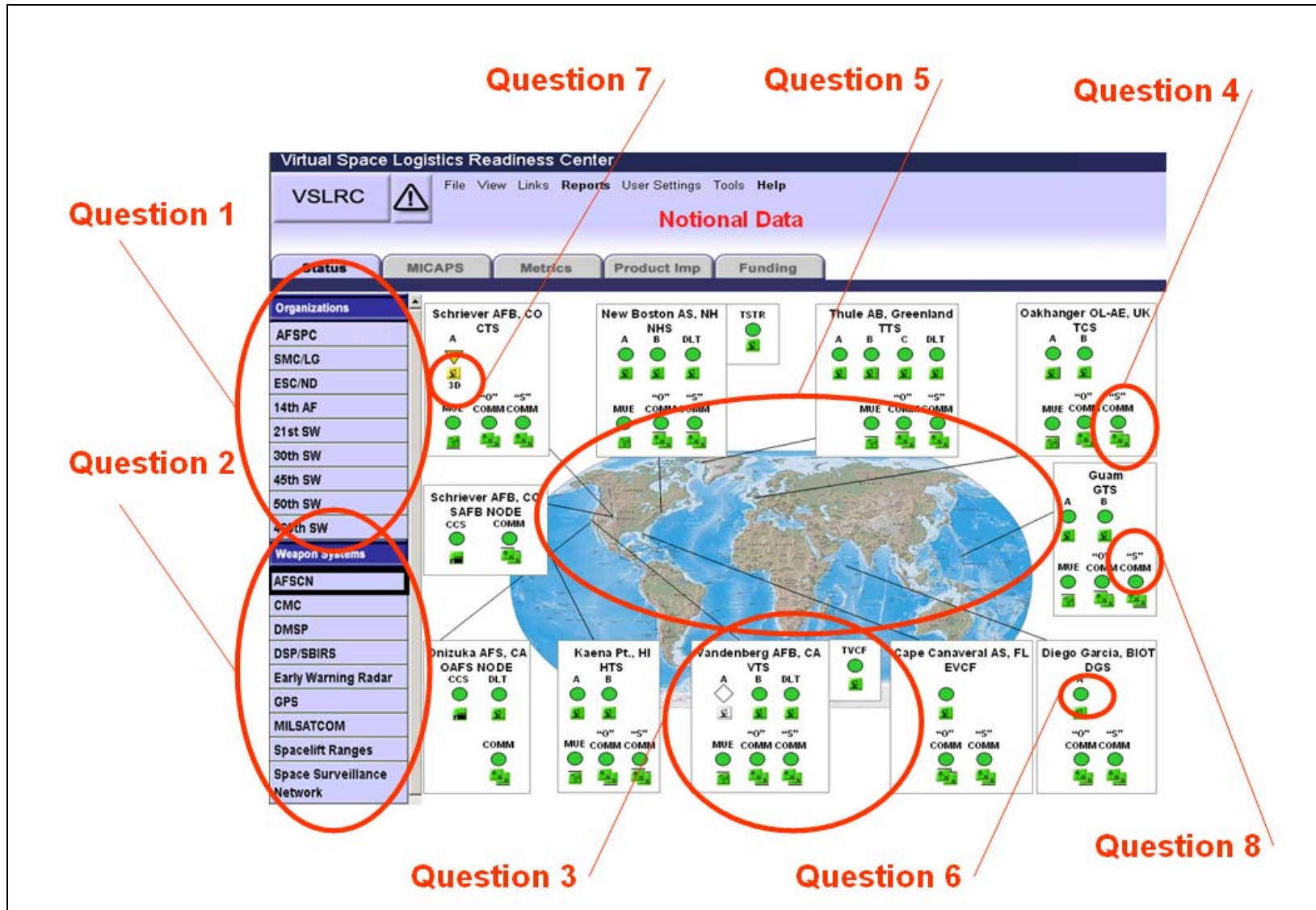
The following 12 questions ask the user about the ability for VSLRC to provide them with situation awareness related to space weapon systems. The term situation awareness can be described broadly as a person's state of knowledge of the situation around him or her. The user was instructed to please rate VSLRC on it's effectiveness for providing situation awareness on the items listed in the questions below.

Please rate the **effectiveness** of VSLRC for providing the following:

CODE	Statement	Not at all Effective 1	Not Effective 2	Somewhat Not Effective 3	Somewhat Effective 4	Effective 5	Extremely Effective 6	NA	Average Score (Std Dev)
ESA	15. VSLRC is effective in providing situation awareness of status of single equipment components.				4	4	1		4.67 (0.71)
ESA	16. VSLRC is effective in providing situation awareness of operations capability of each weapon system.				6	3			4.33 (0.50)
ESA	17. VSLRC is effective in providing situation awareness of the space asset organizations and their locations.				4	4	1		4.67 (0.71)
ESA	18. VSLRC is effective in providing situation awareness of estimated times to complete equipment maintenance or upgrades				5	3	1		4.55 (0.73)
ESA	19. VSLRC is effective in providing situation awareness of overall weapon system health status.				5	4			4.44 (0.53)
ESA	20. VSLRC is effective in providing situation awareness of weather status.		1		1	4		3	4.33 (0.21)
ESA	21. VSLRC is effective in providing situation awareness of weapon systems status history.			1	2	4		2	4.43 (0.79)

CODE	Statement	Not at all Effective 1	Not Effective 2	Somewhat Not Effective 3	Somewhat Effective 4	Effective 5	Extremely Effective 6	NA	Average Score (Std Dev)
ESA	22. VSLRC is effective in providing situation awareness of single equipment component status history			1	1	5		2	4.57 (0.79)
ESA	23. VSLRC is effective in providing situation awareness of MESL for each weapon system.			1	2	1		5	4.0 (0.81)
ESA	24. VSLRC is effective in providing situation awareness of communication capability of each weapon system.			1	3	4		1	4.37 (0.74)
ESA	25. VSLRC is effective in providing situation awareness of location specific site status (active, hot, warm, no status)				2	5		2	4.71 (0.49)

Please rate your **level of agreement** with the following statements.

CODE	Question	Strongly Disagree 1	Disagree 2	Slightly Disagree 3	Slightly Agree 4	Agree 5	Strongly Agree 6	Average Score (Std Dev)
UUI/ ETL	26. I believe I became more productive quickly using VSLRC				6	3		4.33 (0.50)
UUI/ TIM	27. It takes less time to make decisions with regard to problems within a weapon system			2	5	2		4.0 (0.71)
UUI/ ECP	28. It is easy to find the information I needed				6	3		4.33 (0.50)
UUI/ ECP**	29. The information is effective in helping me complete my tasks			1	6	4		4.27 (0.65)

CODE		Question	Strongly Disagree 1	Disagree 2	Slightly Disagree 3	Slightly Agree 4	Agree 5	Strongly Agree 6	Average Score (Std Dev)
UUI/ ECP	30.	The organization of the menus and information lists seems quite logical and useful				3	6		4.67 (0.50)
UUI/ FUN**	31.	VSLRC has all the functions and capabilities I expect it to have		1	2	5	3		3.91 (0.94)
UUI/ USE	32.	Using VSLRC in my job enables me to accomplish tasks more quickly.		1	2	3	3		3.89 (1.05)
UUI/ USE	33.	Using VSLRC improves my job performance		1	1	4	3		4.0 (1.0)
UUI/ USE**	34.	Using VSLRC increases my productivity			2	5	4		4.18 (0.75)
UUI/ USE	35.	Using VSLRC enhances my effectiveness on the job		1		5	3		4.18 (0.87)
UUI/ USE	36.	Using VSLRC makes it easier to do my job				6	3		4.33 (0.50)
UUI/ USE	37.	I have found VSLRC useful in my job			1	4	4		4.33 (0.71)
UUI/ ETL/ EOU	38.	Learning to operate VSLRC was easy for me				2	6	1	4.89 (0.61)
UUI/ EOU	39.	I find it easy to get VSLRC to do what I want it to do			1	3	5		4.44 (0.73)
UUI/ EOU	40.	I find my interaction with VSLRC to be clear and understandable			1	2	6		4.55 (0.72)
UUI/E OU	41.	I find VSLRC to be flexible to interact with			1	3	4	1	4.55 (0.88)
UUI/ EOU	42.	It was easy for me to become skillful at using VSLRC.			1	3	4	1	4.55 (0.88)
IIU/ EOU**	43.	I find VSLRC easy to use			1	2	4	3	4.91 (0.94)

CODE		Question	Strongly Disagree 1	Disagree 2	Slightly Disagree 3	Slightly Agree 4	Agree 5	Strongly Agree 6	Average Score (Std Dev)
UUI/ SAT	44.	I feel comfortable using VSLRC				3	5	1	4.78 (0.67)
UUI/ SAT**	45.	Overall, I am satisfied with VSLRC			1	2	7	1	4.72 (0.79)
UUI/ REP	46.	It is easy to post reports.			3	4	1	1	4.0 (1.0)
UUI/ REP	47.	It is easy to view posted reports.			1		8		4.78 (0.67)
UUI/ REP	48.	It is easy to download posted reports.			3		6		4.33 (1.0)
UUI	49.	The technologies provided are usable				3	6		4.67 (0.50)
UUI	50.	I am provided with useful decision support				5	4		4.44 (0.53)
UUI**	51.	This technology positively impacts the visibility of status of space logistics assets				4	7		4.64 (0.50)
OSA	52.	It is easy to notice when there are problems with equipment				3	6		4.67 (0.50)
OSA	53.	When problems occur, it is easy to understand the problem			2	4	3		4.11 (0.78)
OSA	54.	When problems occur, I am able to predict when the problem will be fixed			2	6	1		3.89 (0.60)

55. Incorporation of real time sensing technology can improve logistics support. Sensors can be applied to AFSPC assets to provide information such as the following:
- Location
- Status (is it broken, in use, not in use)
- Battery level
- Fluid levels
- Temperatures
- Vibration
- Etc.

What information could be sensed from these assets and integrated with VSLRC to improve your decision making and where/how would you use that information?

Comments:

Spiral Two Questionnaire Feedback Comments

User comments by question are presented below and grouped by category.

Category	Question	Comment
Visualization	Question 6: The visualization of status indicators (yellow, green, red) are:	• What metric is used to determine red, yellow, green? Define the metric used for determining status.
	Question 8: Labels on status indicators, equipment, etc. are	• Going to the Help menu for the Acronym List is time consuming. An Acronym Tab could eliminate the need to go extra steps. • Need to have a "key/legend" explaining what each acronym stands for.
	Question 9: Overall, the visualization of the weapons system view is	• Need to have a "key/legend" explaining what each acronym stands for. • Most users are pretty happy, especially since they helped design the screens
Decision Making	Question 10: With regard to supporting my decision making process, the ability to see the status of all weapons systems is:	• Is this system the tool used by all for status? If so it becomes more effective.
	Question 11: With regard to supporting my decision making process for a weapons system, the information provided is:	• Is this system the tool used by all for status? If so it becomes more effective.
	Question 12: With regard to supporting my decision making process for any given site, the information provided is:	• Is this system the tool used by all for status, if so it becomes more effective?
	Question 14: With regard to supporting my decision making process, VSLRC is:	• I believe we are still in a trial period, using the VSLRC in the decision making process will require it to become the standard for all reports/briefings
Situational Awareness	Question: VSLRC provides improved situation awareness of weapon systems	• Right now. • Based on the current state of development
	Question 15: VSLRC is effective in providing situation awareness of status of single equipment components.	• Needs more detail info in write-up
	Question 17: VSLRC is effective in providing situation awareness of the space asset organizations and their locations.	• SA of organizations was not really part of the design.
	Question 18: VSLRC is effective in providing situation awareness of estimated times to complete equipment maintenance or upgrades.	• Will be very effective if detailed information is given. Don't make people have to guess about what's being reported. • Needs to be as specific as possible

Category	Question	Comment
	Question 19: VSLRC is effective in providing situation awareness of overall weapon system health status.	• Will be more effective if information is detailed and up-to-date. • The criteria for health is still pending.
	Question 20: VSLRC is effective in providing situation awareness of weather status.	• Never tried it • Weather is usually not updated for the sites
	Question 21: VSLRC is effective in providing situation awareness of weapon system status history.	• Time will enable the history to contain relevant information • Maybe after it's been used for a period of time. • Never tried it. • Not seen
	Question 22: VSLRC is effective in providing situation awareness of single equipment component status history.	• Time will enable the history to contain relevant information • Maybe after it's been used for a period of time. • Having just one window for historical tracking versus a current one then the history will enable users to get to the info easier • Never tried it • Didn't see the detail on this
	Question 23: VSLRC is effective in providing situation awareness of MESL for each weapon system.	• Have not seen any references to MESL, don't know if I am missing it or it is used in the background • Approved MESL does not currently exist • We do not have approved MESLs. • VSLRC is not as detailed as other sources for the MESL for each system
	Question 24: VSLRC is effective in providing situation awareness of communication capability of each weapon system.	• Will be very effective if detailed, up-to-date information is displayed • ????? • This is hard to define. • Effective if it highlights comm systems used • VSLRC provides comm status but not capability since it does not provide operational impacts
	Question 25: VSLRC is effective in providing situation awareness of location specific site status (active, hot, warm, no status).	• Do not understand the reference • Yes but not in terms of real or near real time.
Timeliness	Question 27: It takes less time to make decisions with regard to problems within a weapon system.	• Sometimes I still have to refer to the SITREP for additional information • If the information is detailed and up-to-date, then yes. • Because I needed to get outside info not detailed in status
Effective Presentation	Question 28: It is easy to find the information I need.	• A detailed listing of all equipment at each location would be helpful • I'm not too familiar with the program so it is currently taking some time to find the information. This will improve with time and program familiarity. • Some of the information would be hard to find for a new user since the information is in different locations i.e. MICAPS, Production slides, etc.
	Question 29: The information is effective in helping me complete my tasks.	• A detailed listing of all equipment at each location would be helpful • N/A

Category	Question	Comment
Functionality	Question 31: VSLRC has all the functions and capabilities I expect it to have.	• The VSLRC is still not the norm, when this becomes true, functions and capabilities can better evaluated • A detailed listing of all equipment at each location would be helpful • Links to 14AF Newsgroup could add more fidelity on outages • Additional functions/capabilities are needed/planned. • VSLRC needs to be made so that we can place multiple write ups for sites in different windows. Right now you have to clump them together in one window • Some functionality has not yet been developed
Usefulness	Question 32: Using VSLRC in my job enables me to accomplish tasks more quickly.	• Not always sure of the accuracy and currency of the data, additional sources are sometimes needed for confirmation of info. • If a hot SIPR connection was on my desk it would be.
	Question 33: Using VSLRC improves my job performance.	• Only for high-level discussions.
	Question 34: Using VSLRC increases my productivity	• It will, once it becomes more established and is populated with all the information I need. A detailed list of equipment at each location.
	Question 35: Using VSLRC enhances my effectiveness on the job	• Only because it has access to the status briefings that speak about financial issues.
	Question 36: Using VSLRC makes it easier to do my job.	• Only because it has access to the status briefings that speak about financial issues.
	Question 37: I have found VSLRC useful in my job.	• It will, once it becomes more established and is populated with all the information I need. A detailed list of equipment at each location • Only because it has access to the status briefings that speak about financial issues
Ease of Use	Question 39: I find it easy to get VSLRC to do what I want it to do.	• Still not sure of all the capabilities • It will, once it becomes more established and is populated with all the information I need. A detailed list of equipment at each location.
	Question 42: It was easy for me to become skillful at using VSLRC.	• Not sure I know of all the functions/capabilities of VSLRC
Satisfaction	Question 45: Overall, I am satisfied with VSLRC.	• It will be more useful once it becomes more established and is populated with all the information I need. A detailed list of equipment at each location. • Needs to have more info and links to show history and status of equipment
Reporting	Question 46: It is easy to post reports.	• Never had to post reports, no comment not available • Don't know yet • Never used
	Question 47: It is easy to view posted reports	• No comment
	Question 48: It is easy to download posted reports.	• No comment • Don't know • Never downloaded.

Category	Question	Comment
Usability	Question 49: The technologies provided are usable.	• Better to pull information for this system from CAMS
	Question 51: This technology positively impacts the visibility of status of space logistics assets.	• It will, once it becomes more established and is populated with all the information I need. A detailed list of equipment at each location.
Overall Situational Awareness	Question 53: When problems occur, it is easy to understand the problem.	• What kind of problems? • If detailed information is given. • Never happened • Usually have to verify with other, more detailed information
	Question 54: When problems occur, I am able to predict when the problem will be fixed.	• What kind of problems? • Only if detailed, correct and up-to-date information is given • Never happened to me. Don't use it extensively enough.
Sensors	Question 55: Incorporation of real time sensing technology can improve logistics support. Sensors can be applied to AFSPC assets to provide information such as the following: Location, Status (is it broken, in use, not in use), Battery level, Fluid levels, Temp	• Any information that produces a change in the status of the system should be reported and the information that drove the status change should also be available. • Real time sensing will greatly enhanced SA and decision making. This info will allow reports/talking paper to go up the chain quicker. • Budget available versus budget needed for the execution and out years. • Tie into CAMS and comm systems • Space is not as dynamic as Air. Maybe for the supply status with items in forward stocking locations; such as the last tested status of items sitting on the shelf. • Some examples: If a ground antenna was not operating and sensors showed this in real-time and the reason was maintenance, this information would be valuable. For ranges, which have a configuration tree, if they could see what was mandatory for launch and what was broken. He also thinks low density/low-demand assets would be valuable to track because they are something that are not used a lot; therefore, they do not have a demand on the supply system, so supply would not have spares ready, and they could have a single point failure. He would like to be able to see when radoms blow off in high winds.